

THE PARASITES OF THE "STUMPY-TAIL" LIZARD,
TRACHYSAURUS RUGOSUS.

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The lizard, *Trachysaurus rugosus*, is widely distributed in the drier parts of Australia, and is especially common in South Australia. It is known variously as the shingle-back, stumpy-tailed, sleepy or sleeping lizard.

The ectozoa known to occur on this reptile are all members of the Acarida. The entozoa include Protozoa, Trematoda, Cestoda, and Nematoda.

ACARIDA (*Ixodoidea*).

Ticks are present rather frequently on the species, especially in the auditory meatus, and may occur also behind the limbs. Two species have been described, *Aponomma trachysauri* Lucas, and *Amblyomma albolimbatum* Neumann.

Aponomma trachysauri (Lucas) Neumann.

It was originally described by Lucas (1861, 225), from European material, as an *Ixodes* and the host was quoted as *Trachysaurus scaber*. Neumann (1899, 43) transferred it to *Aponomma*, and, later (1911, 96), gave a short description of it in his Monograph. Ferguson (1925) referred to it in his key to Australian ticks, and stated that it was doubtfully placed on the Australian list, though the name *T. scaber* probably referred to *T. rugosus*. The possibility of the tick having become attached to the lizard while in captivity in the Paris Museum menagerie is mentioned. Neumann's key to the species has been reproduced by Patton and Cragg (1913, 622-3). Fielding (1927, 88) published an account of it, based on the earlier description and reproduced Neumann's figures.

Amblyomma albolimbatum Neumann.

This tick was described by Neumann (1907, 218) from male specimens taken from *Trachysaurus rugosus* in Holland. He gave a summary in 1911 (p. 86). Patton and Cragg (1913) referred to it in their key to species of the genus. Robinson (1926, 224) described both sexes and mentioned the presence of the parasite on that lizard as well as on *Diemenia superciliosa* (= brown snake, *Demansia textilis*) from Western Australia.

Ferguson (1925, 32-3) recorded it from the tiger snake (= *Notechis scutatus*) and *Trachysaurus* in New South Wales, and from a Western Australian "bob-tailed goanna." He also gave a key to Australian species of the genus based on earlier keys of Neumann and of Patton and Cragg (1913, 612-9). Fielding (1927, 86) published a brief account of the species from specimens collected in North Queensland from *Trachysaurus* as well as from *Varanus varius*. The species is fairly commonly met with on the sleepy lizard in New South Wales, Victoria, and South Australia.

ENTOZOA.

A number of these lizards have been examined for entozoa from time to time. Several different types of Protozoa have been met with, and occasionally cestodes and nematodes. Trematodes have been described from a specimen from the New York Zoological Garden, but they have not yet been encountered here, though searched for.

PROTOZOA.

FLAGELLATA.

Flagellates were frequently found in the rectum, often in company with Oxyurid nematodes (*Veversia*). No attempt was made to study these organisms beyond a broad identification.

Copromonas, sp. The species has an almost circular "body," about 0.015 mm. in diameter.

Bodo, sp. A long but very narrow species with a much wider fusiform posterior region, and with a flagellum about twice as long as the "body."

Trichomastix or *Trichomonas*, sp. A very minute form.

SARCODINA.

There appear to be two distinct species of endamoebae present in the rectum.

Endamoeba, sp. 1 (fig. 2):—A rather compact small species measuring 0.025 to 0.03 mm. in diameter when all pseudopods are withdrawn, was present in the rectum. The ectoplasmic zone is about 3 to 5 μ in width, and is rather sharply marked off from the endoplasm. Locomotion is very slow. Pseudopods are relatively short, broad and blunt, may be developed from any part of the surface, and several may be present at one time. They are composed chiefly of ectoplasm. The encysted stage is spherical, measuring 0.018 to 0.03 mm. in diameter, and surrounded by a very thin cyst wall.

Endamoeba, sp. 2 (fig. 3):—This is a much larger species, measuring 0.04 to 0.05 mm. in width, according to the degree of protrusion of the pseudopod. When the latter is fully formed, the organism may measure 0.07 to 0.08 mm. long. The ectoplasm is 5 to 10 μ in width, according to the condition of the relatively large pseudopod. The latter develops from one end and, when fully formed, the organism becomes more or less pyriform. At the opposite extremity a firmer region constitutes a short, bluntly rounded "tail" which is more or less persistent. Movement is more active than in species 1. The round cyst measures 0.042 to 0.045 mm. and exhibits very little ectoplasm. The nucleus has a diameter of about 12 μ . The parasite occurs in the rectum.

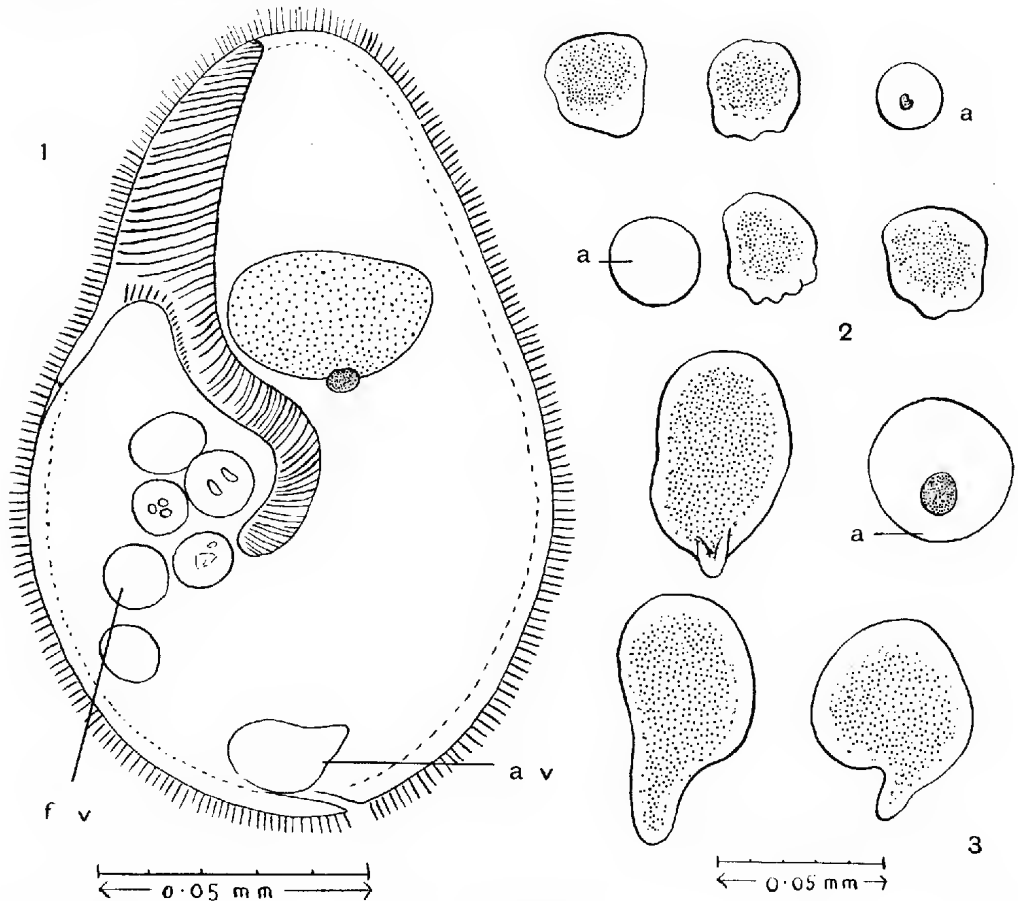
CILIATA.

Nyctotherus trachysauri, n. sp. (fig. 1).

This large ciliate was found in the rectum of several lizards, sometimes sparingly, sometimes in abundance. The length is about 0.14 to 0.16 mm., and breadth 0.10 to 0.11 mm. Some small, probably young, specimens measured 0.125 by 0.075 mm. The anterior portion is slightly narrower than the posterior. The vestibule after dipping down into organism is of an even width, 0.01 mm., this portion being about 0.06 mm. long and slightly curved. While the cilia on the general surface are very fine and measure about 5 μ long, those in the vestibule are much coarser and are three times as long, especially at the beginning of the cytostome, becoming smaller in the cytopharynx. The cortex is about 8 μ thick. The medulla lying anterior to the meganucleus is much denser than the remainder. The meganucleus, which lies adjacent to the anterior half of the cytopharynx, is transversely situated, and measures 45 μ by 32 μ . The micronucleus, lying just behind it and close to the cytopharynx, measures about 10 μ . The anal aperture is not quite terminal, and its canal, which is about 15 μ long, passes inwards obliquely, nearly parallel to the margin of the organism.

Specimens remained alive for three days at room temperature in a receptacle containing lizard faeces and water (October). Smears containing the parasite have been deposited in the South Australian Museum.

Doflein (1928, 1,187) mentions one species, *N. harani* Grassi, as occurring in a reptile, a gecko, but most species from vertebrates are from Amphibia. The position of the anal pore, the form of the anal tube, and the position of the cytostome distinguish the parasite from all others whose descriptions are available. One species, identified by Raff (1911) as *Nyctotherus cordiformis* Ehrb., is very common in the rectum of Australian frogs.



Figs. 1, 2, 3.

Fig. 1, *Nyctotherus trachysauri*; 2, *Endamoeba*, sp. 1; 3, *Endamoeba*, sp. 2. a, cyst; a v, anal vesicle; f v, food vacuole.

Figs. 2 and 3 drawn to same scale.

TREMATODA.

Paradistoma trachysauri (MacCallum) Dollfus.

MacCallum (1921, 173) gave a figure and brief account of a small trematode, *Paragonimus trachysauri*, from the gall-bladder of a *Trachysaurus* which died in the New York Zoological Garden. As has been pointed out by Dollfus (1922, 329), the worm belongs to a quite different family and genus—*Paradistoma* Kossack (Dicrocoeliinae), and is intermediate between *P. mutabile* (Molin) and *Dicrocoelium concinnum* (Braun).

Paradistomum maccallumi, nom. nov.

MacCallum (1921, 176) described a second trematode from the gall-bladder of the New York animal and named it *Cephalogonimus trachysauri*. Chandler

(1923) excluded it from that genus and thought that it should be placed in a new one. Moghe (1930) followed Chandler and did not include it in his key to the species of *Cephalogonimus*. MacCallum did not see the termination of the cirrus and uterus, "though they disappeared behind the pharynx and mouth to terminate on the dorsal surface of the anterior end." The position of the testes and ovary and the character of the uterus are not those of *Cephalogonimus*. If one contrasts this species with that described by him as *Paragonimus trachysauri*, it will be noticed that the two are very similar and the general organography is practically the same. Apart from the difference in size, and especially in breadth, the main differences are the extension of the uterus beyond the ends of the intestine, the more voluminous and more-lobed crura, and the (probably) more forward position of the genital aperture.

The species is obviously a *Paradistoma* and closely related to, if not identical with, the preceding species. In view of the differences noted, it is advisable to re-name it as *P. maccallumi*, since the specific name is already preoccupied in the genus. Dollfus (1922) has emphasised the variability occurring in *P. mutabile*.

The genus *Paradistoma* is known to be represented in Australia by *P. crucifer* (Nicoll) Travassos—originally described (Nicoll, 1914) as a *Eurytrema*—from the gall-bladder of a limbless lizard, *Delma frazeri*. The latter is quoted in error by Travassos (1919) as *Dalura frazeri*.

CESTODA.

Oochoristica trachysauri (MacCallum) Baer.

MacCallum (1921, 229) gave a very brief description of *Taenia trachysauri* from a *Trachysaurus* which died in the New York Zoological Park. This account has been summarised by Baer (1927, 180) who assigned the species to *Oochoristica*, a genus which he placed in the Anoplocephalidae, Linstowinac. Beddard (1914) and Baylis (1919) have emphasised the close relationship existing between the genus and *Linstowia*, though the latter author thought that both genera belonged rather to the Dilepinidae than to the Anoplocephalidae, and should be included in the same subfamily.

This parasite has been collected on several occasions from *T. rugosus* in South Australia where it is common, and occasionally in the drier parts of New South Wales, Victoria and Southern Queensland. Sometimes the worms were present in such numbers as to fill the lumen of the intestine. Since the original description is incomplete, it may be supplemented.

The largest worm measured 220 mm. in length, but most were between 100 and 150 mm. The short neck was 0.3 to 0.5 mm. long by 0.4 mm. wide, being as wide as, or slightly wider, than the scolex. The width is about 0.55 mm. at 1.5 mm. behind the head, while at 7.5 mm. from the scolex segments are 0.5 to 0.6 mm. long by 0.63 to 0.65 mm. broad, and have the sex organs, other than the genital cloaca, developed. At 15 mm. they measure 1.1 mm. long by 0.65 mm. broad, and the cirrus sac is more elongate, and the genital pore open. Proglottids at full sexual maturity are about 1.5 mm. long by 0.9 mm. broad. Some very long segments, 4.4 mm. by 1 mm. broad, were observed and these contained eggs, testes, well-marked sex ducts and remnants of the ovary and yolk glands. An intercalary segment was noticed extending about two-thirds of the distance across the strobila. There is no overlapping and there is only a slight indentation laterally at the junction of segments, so that the margin of the strobila is practically straight and the form of each segment is rectangular with slightly rounded corners.

The scolex is scarcely marked off from the neck. It is rounded in front and measures 0.2 to 0.25 mm. in length by 0.32 to 0.35 mm. in breadth. MacCallum's

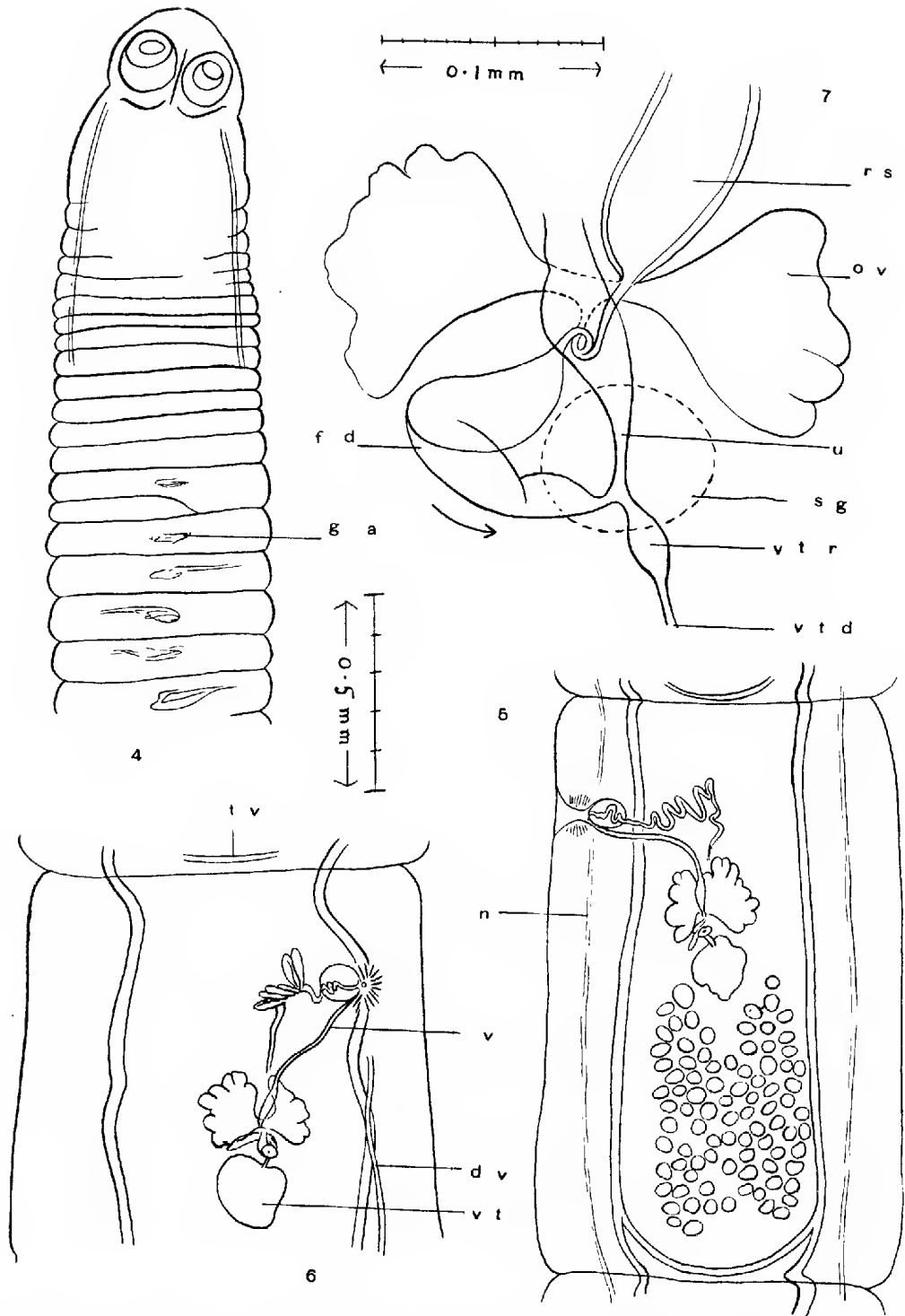


Fig. 4-7 *Oochoristica trachysauri*. Fig. 4, anterior part of strobila; 5, sexually mature segment; 6, portion of segment without common genital pore but with atrium near ventral excretory canal. Figs. 4-6 drawn to same scale. 7, female complex, drawn to scale indicated above it. d v, dorsal excretory canal; f d, fertilising duct; g a, genital anlage; n, longitudinal nerve; o v, ovary; p m s, posterior margin of segment; r s, receptaculum seminis; s g, shell gland; t v, transverse excretory canal; u, uterus; v, vagina; v t, vitelline gland; v t d, vitelline duct; v t r, vitelline reservoir; v v, ventral excretory canal.

figure indicates a triangular rostellum or proboscis which was not observed in the present material. The suckers are relatively large, and almost circular, 0.12 mm. across by 0.13 mm. in depth, their aperture directed forwards. They are muscular and very mobile in life. There is a furrow between the suckers. Calcareous corpuscles are few except in young segments and are usually round (0.007 to 0.015 mm. in diameter). The lateral longitudinal nerves in sexually mature proglottids lie at about one-sixth, or one-seventh, of the segment width from the corresponding margin.

The excretory system possesses the usual ventral and dorsal canals, the latter about half the diameter of the former, except in the scolex where they are approximately equal. The two canals of the same side join to form a loop in front of the suckers and just laterally from the rostellar plug, the loops of opposite sides being connected by a tube of similar calibre. The longitudinal canals become sinuous in the neck. In the segments the dorsal vessel is more wavy than the ventral and usually lies on the outer side of, or above, it. Both are displaced in the region of the sex ducts which pass between them. The ventral canals are connected by transverse vessels which do not originate close to the posterior margin of the corresponding segment, but at a considerable distance in front of it, then bending back almost to the rear border of the segment, so that there is a marked curve in their course. The ventral canals are sharply bent inwards at the posterior edge of the proglottis. Many anomalies regarding the transverse canals were noted, and there may be one or more supplementary canals given off near the posterior corners, and these may end blindly or they may junction with each other or with the main transverse vessel, or there may be two transverse canals (fig. 8). Baylis (1919) refers to certain peculiarities regarding the transverse canals of *O. zonuri* and *O. agamae*. Zschokke has also referred to a somewhat similar condition in *O. rostellata*. It does not occur in *O. truncata*.

The genital cloaca alternates irregularly and lies at about the junction of the first and second quarters of the margin of each segment and is not marked by any obvious prominence. It is fairly wide and deep and surrounded by powerful radiating and sphincter muscle fibres. The sex apertures are close to each other, the female pore being postero-ventral, or directly ventral from the male. In one segment there was no common genital pore to the exterior, the sex ducts terminating in an atrium immediately inwardly from the excreting canals (fig. 6).

The separate testes are recognisable in segments 5 mm. from the anterior end, as also are the rudiments of the ovary and vitellarium, while a mass of more deeply staining tissue indicates the positions of the developing sex ducts. As segments become older this mass extends laterally towards the pore-bearing margin. Between 7 and 8 mm. distance from the scolex, the ovary, shell gland and yolk gland, and also the inner parts of the vas and vagina, are now recognisable, though the latter ducts are not yet tubular. At 15 mm. the cirrus sac is elongate and the genital pore open. Sperms were present in the seminal vesicle and receptacle at 2.5 mm. from the scolex.

Testes are much more numerous than MacCallum indicates, and are not distributed in two groups, as he figured them. There are 65 to over 80 arranged behind the level of the ovary and may extend further forward than the yolk gland, there being a small area behind the latter free from them. They extend from the excretory canals of one side to those of the opposite margin, but do not reach the posterior end of the segment. They are about 0.06 mm. in diameter, but may be 0.045 to 0.07 by 0.06 to 0.08 mm. The vas deferens travels forwards as a narrow tube parallel to and near the ootyp and receptaculum, crossing over the ovary near its bridge and rather nearer the midline than the female ducts. It becomes thrown into a number of short loops in front of the level of the cirrus sac and inwardly from the excretory canals. This vesicula seminalis, which has

thickened walls, crosses above the vagina, or may pass outwards in front of it, to enter the cirrus sac within which it becomes thin-walled and thrown into a series of folds or loops when the cirrus is retracted. The latter measures 0.12 mm. long by 0.025 to 0.035 mm. wide. Surrounding the vesicula in the vicinity of the excretory canals are large cells, probably prostate. Self-fertilisation was observed in one segment, the cirrus being bent round to be inserted into the vagina lying directly below the sac and a mass of sperms was present in the outer part of the female duct. The cirrus sac is rounded, 0.1 to 0.14 mm. long by 0.08 to 0.01 mm. in greatest width. When the penis is retracted the sac does not extend inwards as far as the ventral excretory canal, though it may reach the



Fig. 8.

Fig 8, *Ochoristica trachysauri*. Series of camera lucida drawings to illustrate variability of the transverse excretory canal system. Lettering as in preceding figures.

dorsal. It generally lies just in front, parallel to and on a higher dorsal level than the vagina, and also above the longitudinal nerve.

The ovarian wings are connected by a very narrow bridge and are themselves slightly lobed. In mature segments with a developing uterine reticulum, the organ may measure 0.25 mm. across and 0.13 to 0.17 mm. long. The wings extend dorsally and may not be quite symmetrical, the inner being slightly longer. There is a short oviduct from the middle of the bridge passing backwards and becoming curved to join the wide fertilising duct between the ovarian lobes.

The vagina travels inwardly from the female pore directly below the outer portion of the cirrus sac and then above the ventral excretory canal, becoming a

narrow tube which eventually widens into a long fusiform or pyriform receptaculum, the form depending on the sperm content. The narrow end is directed anteriorly, while from the broader posterior end which abuts on the ovarian bridge, there issues a very narrow duct crossing above the ovary and then bending ventrally to enter the widened fertilising duct. The latter is thrown into a few wider overlapping loops extending behind and below the shell gland and then becomes suddenly narrowed, receives the vitelline duct and enters the shell gland from below. It then travels anteriorly in a sinuous curve as a narrow uterine duct, above the fertilising duct and ovarian bridge. It may be above the receptaculum, or between it and the vas deferens. It now divides up into a loosely branching reticulum in which the eggs come to lie singly in capsules. These rounded capsules, which measure 5 to 6 μ by 3.5 to 4.5 μ , occupy a large part of each ripe segment and occur laterally above the ventral excretory canals. Eggs are 3.7 to 4.2 μ by about 3 μ , generally 4 by 3 μ , and were present in two-thirds of the length of a strobila of 150 mm. The embryo is almost round and measures 2.5 to 3 μ .

The shell gland is rounded to elliptical, 0.08 to 0.15 mm. across, and lies immediately in front of the vitellarium. The latter is 0.12 to 0.15 mm. wide, and 0.16 to 0.18 mm. long. Its short duct arises from near the anterior end and joins the fertilising duct immediately before penetrating the shell gland from below. The form of the yolk duct and ootyp varies according to the degree of elongation of the segment. There may be a small yolk reservoir.

Meggitt (1920) and Baer (1927) have published keys to the species of the genus *Oochoristica*. According to that given by the former, *O. trachysauri* would be near *O. agamac* and *O. wagneri*, more particularly the latter, because of the very large number of testes. If Baer's key be followed, then the species would fall near *O. zonuri*.

NEMATODA.

Veversia tuberculata (Linstow) Thapar.

In 1904 Linstow briefly described *Oxyuris tuberculata* from *Trachysaurus*. Subsequently Thapar (1925, 114-7) erected a new genus, *Veversia*, for its reception and gave additional information and figures regarding it, his figures being reproduced by Yorke and Maplestone (1926, 201-2). This parasite is rather common in the rectum of the lizard, and I have seen specimens from localities in South Australia, Victoria, New South Wales and Southern Queensland.

Oxyuris (sensu lato), sp., Thapar.

Thapar (1925, 130-2) gave an account of an Oxyurid of which only females were present. The species was regarded as being near, but distinct from, the genera *Pharyngodon* and *Thelandros*, from both of which the anterior position of the vulva excludes it. The genus *Oxyuris* is now restricted to species resembling *O. equi*, but Thapar's account shows that this form is closely related. No locality is mentioned.

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